Improving

Rural Access

to Information Technology in Nebraska

The Rural Challenge

Information technology is changing the way people communicate, conduct business, learn, and gain access to services. In order to prosper in the increasingly competitive global economy, rural communities must be prepared to fully participate in the Information Age.

Evidence indicates that those living in rural areas are less likely to use information technology and often encounter barriers in gaining access to affordable high-speed services. The U.S. Department of Commerce's 1999 report, *Falling through the Net III: Defining the Digital Divide* found that regardless of income, rural residents were less likely to own a computer and to have access to the Internet. Data from a statewide study confirms that a digital divide exists between metropolitan and rural areas of Nebraska. While 60 percent of metropolitan Nebraskans had a computer in their home in 1998, only 46 percent of non-metropolitan Nebraskans owned a home computer. Sixty-five percent of the state's metropolitan computer owners had a subscription with an Internet provider, compared with 49 percent of non-metropolitan computer owners. The disparity in the use of information technologies between metropolitan and non-metropolitan Nebraskans were also found in the workplace. Sixty-eight percent of the metropolitan respondents used a computer at work, while 50 percent of the non-metropolitan respondents used a computer at work. (Fergason & Rockwell).

Rural communities in Nebraska are also less likely to have access to high-speed services. The recently released Telecommunications Infrastructure Needs Assessment (TINA) Communities of Interest Needs Analysis Report documents the disparity in services in Nebraska. The report found that substantial fiber, frame relay, ATM, cable and competitive services providers are available in Nebraska's largest communities (the Omaha metropolitan area, Lincoln, and Grand Island). Most communities with populations of 20,000-25,000 are receiving enhanced telecommunications speeds, bandwidths and services, including some DSL. However, the availability of advanced services drops off rapidly as population density declines. While nearly all communities in Nebraska now have local dial-up Internet access, small rural communities--particularly in central and northeast Nebraska, are limited to 28.8 Kbps facilities.

Although the Telecommunications Act of 1996 was intended to promote competition (leading to lower prices and improved services), competition among service providers is slow in coming to rural areas. Telecommunications, like many other industries, realizes economies of scale. Large telecommunications providers can afford to invest in urban areas where fixed costs can be spread over more customers and the return on investment is greater. Although small telecommunications providers may be willing to invest in rural areas, they are often unable to match the prices offered in metropolitan areas for comparable services. Smaller telecommunications providers serving rural areas are unable to realize the economies of scale of those serving metropolitan areas. Additionally, the cost of providing high-speed access in rural Nebraska is determined in part by the number of miles to a connection to the Internet backbone and the number of connections between telecommunications providers that must be made.

In short, rural communities are faced with a two-fold challenge: In order to remain competitive in the emerging digital economy, they must 1) increase utilization of the telecommunications services in their communities and 2) improve access to telecommunications infrastructure and services. Only when market forces equal or exceed the cost of providing advanced services, will these services be available in rural areas.

UN**IT**ED **2000**: Strategies for Nebraska

The State of Nebraska's newly released statewide technology plan, entitled UN**IT**ED **2000,** promotes effective planning and coordination of information technology within Nebraska. Individuals representing agriculture, business, health, libraries, law enforcement, local and state government, and all levels of education invested hundreds of hours in the development of UN**IT**ED **2000**. The title recognizes not only their collaborative effort, but a common vision of using information technology to improve every Nebraska citizen's quality of life.

UN**IT**ED **2000** identifies goals and priorities of the NITC, lays the groundwork for systematically defining standards and guidelines for the state's technical infrastructure, establishes planning and project management processes, and recognizes specific actions to be undertaken. The thirty-five actions are organized in three themes: actions promoting economic development and universal access, actions promoting information technology efficiency and management, and actions promoting electronic government (or e-government) services.

A number of strategies presented in UN**IT**ED **2000** address the two-fold challenge to IT access and utilization faced by Nebraska's rural communities. The following equation shows the relationship between market forces and the cost of providing advanced services, and selected strategies and mechanisms to address each side of the equation.

Market Forces (demand and utilization) > **Costs of Providing Advanced Services**

Strategies:

- Aggregating demand and securing an anchor tenant
- Providing information and services online
- Providing public access
- Stimulating demand
- Addressing barriers to usage and sustainability

Strategies:

- Universal Service Fund

Develop recommendations for aggregating demand for telecommunications networks by public entities. The State of Nebraska is among the state's largest consumer of telecommunications services. By aggregating the state's demand, the state can contract with private telecommunications companies to consolidate statewide communications services. By acting as an anchor tenant in each of the communities in which the State of Nebraska has a presence, the deployment of advanced services in these communities will be accelerated. The per unit cost of advanced service to the state will typically be less. Several states, including Tennessee and Pennsylvania, have successfully entered into private-public partnerships to develop statewide telecommunications networks using this approach.

Aggregating demand and securing an anchor tenant are strategies that can also be used by local communities. By aggregating demand, communities can present a stronger business case to telecommunications providers. When building Norfolk's Lifelong Learning Center, the tenants were able to negotiate more favorable rates for services by aggregating their demand. A large consumer of telecommunications services in a community can serve as a telecommunications anchor tenant. Once a telecommunications provider has made advanced services available to the anchor tenant, it can extend those services to other businesses, public entities, non-profit organizations, or individuals in the community.

Providing information and services online. Providing information and services online improves citizen access to government information, bridging the distance between rural residents and state government. Use of the Internet will increase when citizens can transact business online instead of traveling to government offices. Many communities in Nebraska have Web sites. A few, like the City of Lincoln's InterLinc site, are making their sites dynamic sources of information.

Providing public access. As more and more information and services--including those of the local, state, and federal governments--are being made available on the Internet, there is growing concern that the "information have nots" will be disadvantaged. Those who do not have access to information technologies at home, work, or school, are using public access sites. (Falling through the Net:). In order to make information on public access sites more accessible, the Community Council is partnering with the Nebraska Library Commission and

Nebraska Online to develop a web-accessible database of public access sites. Data will also be used to determine how many communities have public access terminals available, where this access is provided, and if access is provided at times convenient to users. The data will allow policy makers to make better informed decisions on the issue of public access. The information will also be valuable as supporting documentation for a number of grant programs which focus on bridging the digital divide.

Stimulating demand and increasing utilization by providing information technology training sessions. Unless people in a community understand how to use information technology, they will not be effective information technology users. There are a number of IT training programs in the state, ranging from introductory Internet training to network certification programs. There is, however, no coordinated plan for addressing the broad spectrum of IT training and development needs in rural communities. The Community Council, in partnership with key stakeholders, will develop a database of IT development resources available to communities, perform a gap analysis to determine if additional resources are needed, and develop recommendations for the NITC.

Addressing institutional and regulatory barriers to utilization and sustainability. It is important to recognize that regulatory and institutional barriers to utilization of information technologies exist. This is particularly true in telemedicine. Telehealth services have the potential to improve access to health services for all Nebraskans. However, the cost of equipment and telecommunications services, the low population density of areas served, and lack of reimbursement by third party payers, are impeding the expansion of telehealth services. In order to provide services across the state, careful assessment and planning are essential. The Telehealth Subcommittee of the Community Council has developed plans for a telehealth feasibility study. The information obtained in the context of this study can be used by planners, in conjunction with current information on costs, to devise multi-year plans for a stepwise, statewide implementation of telehealth technology and applications. The Community Council and the Telehealth Subcommittee, in partnership with the Nebraska Association of Health Systems and Hospitals, will begin working with insurance companies in Nebraska to broaden their policies to include telemedicine consultations as a reimbursable service.

Addressing regulatory and institutional barriers relating to costs of advanced services. The federal Universal Service Fund provides discounts for schools, libraries, and hospitals. The process of filing for applications is lengthy and cumbersome. A recent study found that only 14 percent of the sites approved by the Rural Health Care Division of the Universal Services Administration Company had completed all of the necessary forms to receive reimbursement (RUPRI). Recent FCC decisions on the disbursement of USF monies have raised serious questions about the future of universal service and the affordability of new telecommunications services, like the Internet, for rural high, cost-customers. Federal and State USF formulas, as well as regulatory issues such as cross-LATA surcharges, are commonly identified as potential barriers to eliminating the prospect of a widening digital divide between rural and urban

Nebraska. The NITC has developed a work plan to address these barriers in partnership with the Legislature, the Public Service Commission, the Administration, and other appropriate entities.

About the NITC and the Community Council

The NITC was established by the Legislature in 1998 to establish a statewide strategy for information technology development in Nebraska and to make recommendations regarding information technology investments to the Governor and the Legislature. The NITC consists of nine members appointed by the Governor and confirmed by the Legislature. Members include representatives of K-12 and post-secondary education, communities and the general public. The NITC has three advisory councils in the areas of State Government, Education and Community. In addition, the Technical Panel performs reviews of new and additional technology and originates standards and guidelines.

The Community Council consists of representatives from agriculture, business, health care, libraries, local government, and resource providers. The Community Council normally meets monthly to make recommendations to the NITC. The Community Council is also charged with overseeing the administration of the Community Technology Fund, which provides grant funding for information technology projects in communities.

Information on UNITED 2000, the NITC and the Community Council can be found at the NITC Web site located at www.nitc.state.ne.us .

This information was compiled by Anne Byers, Community Information Technology Manager, NITC, abyers@notes.state.ne.us , (402) 471-3805.

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LYLE D. KORVER

Orange City, Iowa

PROFESSIONAL EXPERIENCE

1998-Present	NORTH WEST REC, Orange City, IA (Consolidated Cooperative – NWREC, Ida County REC & Plymouth Electric Cooperative Association) Executive Vice President & General Manager
1993-1997	NORTH WEST REC, Orange City, IA (Consolidated Cooperative – Sioux & O'Brien) Executive Vice President & General Manager
1989-1993	SIOUX ELECTRIC COOPERATIVE & O'BRIEN COUNTY REC Executive Vice President & General Manager (Shared Manager Arrangement)
1984-1989	SIOUX ELECTRIC COOPERATIVE Executive Vice President & General Manager
1978-1983	SIOUX ELECTRIC COOPERATIVE Office Manager

COMMITTEES & BOARDS

1999-Present	Vice President of Orange City Communications Board
1999-Present	Director on Midwest Electric Consumers Association Board
1992-Present	Midwest Water & Power Marketing Committee
1997	NRECA Marketing & Energy Services Committee

CERTIFICATIONS

NRECA Management Certificate – 1992

EDUCATION

B.A., Business Administration, Northwestern College
Orange City, IA - 1978

Additional Information on Orange City Communications by Lyle D. Korver

Some additional information relating to the Orange City Communications partnership:

Orange City Communications is a three way parternship involving the City of Orange City, Long Lines, Ltd., and North West Rural Electric Cooperative. Orange City Communications was formed in April, 1999, for the purpose of developing and delivering enhanced telecommunications to the citizens and business community of Orange City and the surrounding area.

I serve as Vice President of the Orange City Communications Board. I am also General Manager of North West REC which is headquartered here in Orange City.

Eric D. Stonestrom

Eric Stonestrom is President and Chief Executive Officer of Airspan Networks Inc., and Managing Director of Airspan Communications Limited.

Born in Pennsylvania and educated at the College of Engineering at the University of California at Berkeley, receiving B.S., M.S., and M. Eng. Degrees in 1982, 1983, and 1984 respectively.

Following his education, he worked for eleven years for Bell Laboratories and AT&T entities in New Jersey, Italy, and Holland. He developed AT&T's telecommunications equipment business in both the US and International areas, spending five years designing and marketing operations systems to US RBOCs. He next spent four years in conjunction with Italtel in Milan developing key segments of the Telecom Italia network. Following this, Mr. Stonestrom headed the Operations Systems Business Unit for Europe, Middle East and Africa for AT&T Network Systems International based in Hilversum, Netherlands and managed numerous software and infrastructure projects in the region. Mr. Stonestrom gained significant exposure to both the deregulated and emerging telecommunications worlds, from both network operator and infrastructure perspectives.

Mr. Stonestrom joined DSC Communications Corporation, in October 1995 as the Divisional Vice President of Network Management. He also served as Chairman of Netmand A/S, a joint venture between DSC and Digital Equipment Corporation and as a member of the board of TMN I/S, a joint venture between DSC and Tele Danmark A/S.

He has been managing Airspan in the UK since July 1996. In this capacity he has managed the overall division while it was under the DSC umbrella. Since Airspan Networks Inc. was set up in early 1998, he has served as Chief Operating Officer and now Chief Executive Officer.

A Broadband Fixed Wireless Access System

The US population residing in non-metropolitan counties exceeds 50 million people, according to the last US Bureau of Census 1994. Modern telecommunication networks can serve as a lifeline, piping in quality education, health care and jobs which are crucial to maintaining rural communities as vital production components of our economy, but only if the services are delivered on a competitive infrastructure and priced on par with urban centers. It is well recognized that communication and information technologies such as the Internet can reduce the barriers that disadvantage rural and remote areas. This paper defines a set of services and describes a digital broadband wireless technology that is being deployed to accelerate the delivery of these advanced services, reliably and at a low cost, to suburban, rural and remote areas.

The demand for broadband access is increasing and consequently many methods for delivering this digital information at high speeds to consumers are emerging in the communications industry. One technology, a CDMA based fixed wireless access system from Airspan Networks Inc is deployed in a wide variety of network applications to provide rapid provision of high bandwidth data and high quality voice services. The deployment of fixed wireless access enables rapid infrastructure construction to satisfy the demand for new toll quality, telephony services and data services in licensed bands such as PCS and MDS/MMDS. A fixed wireless access system from Airspan provides the operator with a high bandwidth, data network for leased line services and virtual private network services, high quality voice and offers a suite of products for Internet applications.

The fixed wireless access system from Airspan Networks Inc. uses point to multipoint CDMA based, digital microwave radio links between the individual end-user's premises and the network operator's "local point of presence" as an alternative or to augment the copper pair "local loop". The subscriber terminal at the home is connected via coaxial cable to a small directional antenna, which is installed under the eaves of the house. The subscriber antenna operates on a near line of site basis with the central terminal antenna.

The central terminal and access concentration is located at the "local point of presence" which is typically the local exchange premises for voice services and the ISP provider's network operating center for packet access. The central terminal interfaces to the Internet router at 100 Mbps and to the PSTN. Greater flexibility or range can be achieved by remotely locating the Central Terminal in a suitable building or an environmentally protected roadside cabinet, and connected to the local exchange via radio, cable or fibre ring infrastructure. A minimum system configuration may be deployed to scale capital expense to revenue. This modular design provides for a least cost entry into high-speed data services for the wireless operator, with system costs that are typically less than a copper xDSL or hybrid fiber/cable system.

The construction of a green field network is relatively simple. Base stations are located in areas where customer penetration is expected, and radio coverage prediction is prepared. When a customer in the coverage area requires connection, the operator dispatches an installation technician, and within an hour or less of arriving on the site, the customer has dial tone.

CLASS Telephony Services

As a delivery mechanism for CLASS Telephony Services, fixed wireless provides 64kb/s encoded voice with a performance that exceeds copper-delivered voice. With a wide service footprint exceeding 700 square miles, CDMA based fixed wireless systems can be used to deliver voice services to rural communities cost effectively. The

system supports V.90 56kb/s voice-band modems at a standard subscriber terminal which, enables customers to receive CLASS voice and dial up Internet access.

High Speed Internet Services

The copper access portion of the network in many operators struggles to meet the growing number of users demanding high-performance Internet and remote data connectivity. Inadequate access facilities are not the only challenge facing the local exchange carriers. The public switched network, designed to switch voice traffic, typically lasting three to five minutes, is becoming overloaded with analog modem data calls lasting hours rather than minutes. The projected data use will cost the industry billions of dollars in new switching PSTN infrastructure unless data traffic is diverted from the PSTN.

Technologies that are emerging to address the Internet services opportunity include Digital Subscriber Line (DSL) and Cable Modems. DSL dramatically increases bandwidth to the subscriber utilising the existing copper pair infrastructure. The deployment of DSL, however, is limited by the condition and gauge of the copper pair, the use of party line circuits, and the distance that the subscriber resides from the central office, which can seriously impact the penetration of the technology in rural areas. Cable Modems require the presence of a high-quality bi-directional coaxial cable network, and again, performance is limited by the availability of clean upstream channels. As a consequence, there are challenges for both technologies in delivering high-speed Internet services in remote and rural areas.

Products from Airspan Networks Inc. provision services at ranges up to 15 miles, a significant improvement over current xDSL capabilities, permitting the extension and augment (fill-in) of xDSL system rollouts. A port at the access concentration point allows traditional POTS to be groomed into the PSTN, while packet data is routed to the Internet via an ISP, thereby separating the two types of traffic into their respective networks. A fixed wireless subscriber terminal supports 32 or 64 kb/s-encoded telephony, and an always on, 10baseT port for connection to a PC. Connection speeds can be configured from 128 kb/s to 512 kb/s. Second generation subscriber terminals will provide higher data rates up to 1.5 Mbps.

Data Services

Mission critical applications have migrated from the hierarchical mainframe model to a distributed client server environment. These applications require a 'leased line' data connection, where the availability of the link is assured, and the capacity is at least 128 kb/s. In many cases, these links need to be established quickly, and once established become critical to the operation of the customer's business. Increasingly, small and medium sized businesses are being established in rural and suburban areas, and away from the highly develop telecomm infrastructures that are found in urban and city environments. The Airspan fixed wireless network can provide businesses with the required data circuits for a variety of applications including:

- Connection of a PBX to the operator's switch,
- Network connection to the internet service provider,
- LAN-LAN interconnect,
- Videoconferencing links,
- Private data and secure networks.

Summary

In contrast to large businesses that can readily pay for broadband access, many residential and small business customers are located where alternative Internet access over DSL or high speed cable modems are unavailable or at a high cost, a plight commonly referred to as the Digital Divide. Airspan is providing an economical broadband wireless access system to forward thinking telecommunications companies to bridge the divide.

Mikal J. Thomsen
President and Chief Operating Officer

Mikal J. Thomsen was recently named President & Chief Operating Officer of Western Wireless Corporation after the spin-off of VoiceStream Wireless from Western Wireless in May of 1999.

Prior to his appointment as President & Chief Operating Officer , Mr. Thomsen served as Chief Operating Officer of Western Wireless since its formation in July of 1994. Effective in April of 1998, Mr. Thomsen assumed responsibility for all cellular operations of Western Wireless Corporation.

Mr. Thomsen was Director and Chief Operating Officer of Pacific Northwest Cellular (MARKETS Cellular Limited Partnership) from its inception until the formation of Western Wireless Corporation in 1994.

From 1983 to 1991, Mr. Thomsen held various positions at McCaw Cellular, serving as General Manager of its International Division from 1990 to 1991 and as General Manager of its West Florida region from 1987 to 1990.

John T. Stupka

John Stupka was appointed President, MCI WorldCom Wireless Solutions, on January 19, 2000. Mr. Stupka came to MCI WorldCom as a result of their merger with SkyTel Communications, where he served as President and CEO since August 1996. He is a 26-year telecom veteran with an extensive background in both the wired and wireless industry segments.

Mr. Stupka's new duties include oversight of all current MCI WorldCom wireless initiatives. This includes SkyTel Communications, MCI WorldCom Wireless Solutions (MMDS), development of the company's European wireless strategy and management of MCI WorldCom's Metricom mobile computing investment.

At SkyTel, Mr. Stupka helped develop the wireless messaging company into a strong, marketing-driven organization. This resulted in solid growth of SkyTel's advanced messaging business and led SkyTel to be the only profitable public company in its sector. SkyTel is now well positioned to capitalize on the strong demand for wireless messaging being fueled by the growth of the Internet and a mobile populace.

Mr. Stupka, 50, joined Southwestern Bell Telephone Company in 1974 after receiving a BSIE at the University of Oklahoma and completing a three year military tour. He rapidly advanced through a series of operating assignments and was appointed to Division Manager in 1979. From 1979 through 1983, he managed various organizations serving the business customers in Oklahoma. During this same period, John attended the Bell Advanced Management Program at the University of Illinois.

In January 1984, Mr. Stupka was appointed Vice President – Network for the Southwest Region of AMPS, the AT&T organization that preceded Southwestern Bell Mobile Systems (SBMS). In October of 1984, he was promoted to Executive Vice President and in November of 1985 was promoted to President and CEO. Under John Stupka's leadership, SBMS gained wide recognition as the cellular industry's premier company, leading the industry in both market penetration and operating cash flow. He received numerous industry honors for his work in expanding the industry. In July of 1995, Mr. Stupka was promoted to Senior Vice President – Strategic Planning for SBC Communications. Reporting directly to the SBC Chairman, Mr. Stupka directed both strategy development and SBC's technology arm, SBC Technology Resources, Inc.

MCI WorldCom (NASDAQ:WCOM) is a global leader in "all-distance" communications services with operations in more than 65 countries. Revenues in 1999 were $37 billion, with more than $15 billion from high-growth data, Internet and international services. MCI WorldCom and Sprint have announced a merger agreement, which the companies expect to close in the second half of 2000 after regulatory and shareholder approvals. For more information, go to http://www.wcom.com.

NEBRASKA PUBLIC SERVICE COMMISSION

Anne C. Boyle

District 2

PROFESSIONAL CAREER:

* Elected to the Public Service Commission in November, 1996
* President of Universal Revenue Services since 1992
* Consultant/lobbyist from 1994 to 1995
* Licensed real estate agent from 1987 to 1994
* Active on the Clinton for President Campaign; opened the Omaha campaign office, organized fund raisers, hosted open houses and developed a steering committee
* Campaign manager for a public relations firm from 1990 to 1991
* Corporate/political fundraiser from 1983 to 1985 and 1988
* Omaha office coordinator for U.S. Senator James Exon (D-NE) from 1979 to 1981
* Chair and co-chair for various political campaigns including Whelan for Lt. Governor, Zorinsky for U.S. Senate, Cavanaugh for Congress and Rosenblatt for City Council from 1974 to 1978

COMMITTEES:

* Member, National Association of Regulatory Utility Commissioners and Mid-America Regulatory Commissioners
* Board member, world renowned Bemis Center for Contemporary Arts, located in Omaha
* Nebraska Authorized Representative '96 Clinton-Gore Campaign
* Member, President's Advisory Committee on the Arts in 1995, appointed by President Clinton
* Member, Nebraska Interagency Council on the Homeless
* Member, Finance Committee to Re-elect Governor Ben Nelson
* Member, Nebraska Democratic Party State Central Committee
* Member, Nebraska Review Committee for Federal Appointments for US Attorney, US Marshall, and the Eighth District Court of Appeals Federal Judgeship from 1993 to 1995
* Delegate, Democratic National Convention in 1988, 1992 and 1996
* Co-Chair, Jefferson-Jackson Day Dinner in 1976 and 1982
* Co-Chair, Midwestern Governors Conference in 1984
* Chair, Inaugural Ball Invitation Committee for Governor J. Robert Kerrey, 1982
* Member, Judicial Nominating Committee for the Douglas County Juvenile Court, appointed by Governor J. James Exon
* Chair, Douglas County Democratic Central Committee
* National Committee-woman, Nebraska Young Democrats

PERSONAL DATA:

Born in Omaha, Nebraska, December 22, 1942. She and her husband Mike, the Mayor of Omaha from 1981 to 1987 have five children: Maureen, Michael, James, Patrick and Margaret; and six grandchildren: Alexandria, Sam, Elsie, Riley, McKenzie and Erin. Resides in Omaha.

Michael G. Kienzle, M.D.
Short Biography

Dr. Kienzle is a Professor of Medicine and serves as the Associate Dean for Clinical Affairs and Biomedical Communications in the College of Medicine at the University of Iowa. He is the Coordinator, Iowa Health Services and Education Telecommunications Network and is responsible for coordinating the Health Science uses of the Iowa Communications Network. Dr. Kienzle is also the Project Director for the National Library of Medicine contract supporting the establishment of a UI National Laboratory for the Study of Rural Telemedicine. He has served on the Telecommunications and Health Care Advisory Committee of the Federal Communications Commission and currently chairs the Telemedicine Advisory Committee of the Iowa Telecommunications and Technology Commission, the body responsible for the oversight of the Iowa Communications Network. He serves on the Information Technology and Ad Hoc Telemedicine Committees of the American College of Cardiology.

Dr. Kienzle is a native Iowan. After his medical degree at UI, he spent 7 years in Philadelphia training in Internal Medicine, Cardiology and Cardiac Electrophysiology. Since returning to Iowa City in 1984, he has served as Director of the Cardiac Electrophysiology Laboratory, Assistant Director of Cardiology and Interim Associate Vice President for Clinical Affairs in the Office of the Vice President for Health Sciences.

PRESENTATION TO FCC REGIONAL FIELD HEARING

Michael G. Kienzle, MD
University of Iowa Health Care
University of Iowa

Ladies and gentlemen, it is a real pleasure for me to join you this afternoon. My presentation today will be the oral equivalent of "The Flight of the Bumble Bee". I say this because I have but a few minutes to quickly summarize our experience with telehealth applications in a rural setting and offer you a few of the lessons we have learned over the last six years of work. Parenthetically, we have also been as busy as bees.

In 1994 we were able to leverage the investment the State of Iowa made in the Iowa Communications Network to secure the first of two National Library of Medicine contracts totaling almost $14 million. This support funded the National Laboratory for the Study of Rural Telemedicine from 1994 until just last month. We developed a rural testbed network to develop and study applications of potential importance to rural healthcare. Ten distinct applications were developed and tested, including virtual libraries, advanced radiology, emergency room support, pediatric cardiac imaging and consultation for patients with mental illness or disabilities. Our network linked up to 16 mostly rural hospitals using a variety of connections including T1, DS3, ISDN, frame relay and POTS. Detailed reports of these activities are available on our R&D website at http://telemed.medicine.uiowa.edu. I have also submitted the Executive Summary of our most recent NLM contract into record of this meeting.

In March of 1997 we developed a multi-prison consultation service with the Iowa Department of Corrections to provide specialty consultation to all nine of Iowa's prisons. To date we have provided almost 800 consultations in most of our existing specialties. We have begun to explore the use of telemedicine to address some of the prison's most challenging problems, such as HIV, tuberculosis and hepatitis C, conditions that have become epidemic in most prison systems.

In January of 1998 we developed a home telemedicine company called resourceLink of Iowa, LC, as a joint venture with a company in Kansas. This has proved a wonderful application to provide home nursing care to isolated elderly patients with complex and difficult to manage medical problems. The system uses POTS connected to a 13 inch television and set-top box with camera and also allows the downloading of in-home measurements such as weights, blood pressure, blood glucose and heart sounds. The nurse uses an electronic medical record to plan and document each visit. We have served well over 100 patients, and usually have 50 patients connected at any one time at distances of up to 250 miles. Patients love the service and enjoy real and valuable relationships with their video nurses.

We have made great progress toward providing some of our services over the Internet. In one NLM project we created a community for patients with newly-diagnoses diabetes. We created a special website for patients and their health care providers where information could be made available, patients and providers could message one another and common issues could be discussed in a threaded forum online. Other activities include enhancing our institutional website by adding services like one-on-one discussion with physicians 24 hours a day and expert chats on common medical topics.

Like many telehealth systems, we have taken advantage of these networks to offer a variety of life-long learning opportunities, like departmental grand rounds, special events and support for

adjunct faculty and students in the community. Literally hundreds of ours of programming have been delivered to patients and providers in all corners of the state, reducing the isolation that can accompany rural life. We have also made a number of special programs available for CME credit on the Internet. We have also gained tremendous experience with international videoconferencing, and commonly do programming overseas. One of our faculty members, for example, has provided residency training in his specialty to Austria on a regular basis, as well at a number of US universities lacking in his particular expertise.

So, we have been very busy. In closing, let me quote from the Executive Summary of our recent NLM report.

> "Based on our collective experience gained during the current NLM contract, we offer the following brief and general conclusions:
>
> When carefully designed, implemented and evaluated, telemedicine consultation provides a clinical experience for providers, patients and family that is indistinguishable from more traditional face-to-face encounters.
>
> Actually "doing" telemedicine is difficult. The least of these difficulties is technology. Education, support and training of providers are critical. The need to recognize and mitigate political and social factors that stand in the way of success is often ignored, at considerable peril. The incentives needed for full participation and evaluation of telemedicine are not yet present, particularly in the area of payment for service. We find ourselves in a "no job without experience and no experience without a job" situation, and previous federal initiatives to gain necessary experience (HCFA Waiver program, for example) have been ill designed and executed, and created the (we believe) false impression that telemedicine doesn't work. Under the leadership of the NLM, and with assistance from entities such as the Institute of Medicine, a more accurate picture of telemedicine is emerging.
>
> Considerable economic value is available to patients and their families by the improved access to specialty services and avoidance of costs associated with travel. When considered in the context of the clinical effectiveness of telehealth services, the case for telemedicine is even more compelling from the patient perspective.
>
> For providers of specialty health care services the value proposition is less clear, and may vary considerably from one clinical application to the next. Given the lack of routine reimbursement for telehealth services and the lion's share of easily demonstrable economic value going to patients and families, benefits for telemedicine service providers in the current environment are less direct and must be viewed from a broader health system perspective. This perspective must take into account the favorable impact telemedicine programs may have on referral and other relationships. The extent to which telemedicine is viewed as one of several tools for clinical relationship building and patient care will determine whether decision-makers continue to support telemedicine programs when external funds terminate or are otherwise unavailable. Given the results of our current and past projects (and others), we believe that telemedicine is "safe and effective" and should be made available to patients and reimbursed on the same basis as traditional health care services. While the federal government has

> taken a few halting steps in endorsing this position, much more leadership is needed to put telemedicine on an appropriate footing in the health care system."

Thank you for the opportunity to participate in today's event and I look forward to the question and answer period that follows.

April 19, 2000

EXECUTIVE SUMMARY
By Michael G. Kienzle, M.D.

Introduction

Technology cannot be developed in a vacuum. In the case of telemedicine, its effectiveness is a reflection of the need addressed, the quality of the technology developed, the skill used in its deployment, and the attention paid to social and organizational factors involved in the work of health care. The larger health care environment also plays an important facilitating or inhibitory role through reimbursement policy, health system consolidation and integration, and changes brought about through marketplace reform. Given the complexity of the health care environment, it is not surprising that rigorous evaluation of technologies like telemedicine are difficult, and data supporting the effectiveness of telemedicine technologies have been limited.

In 1994, the National Laboratory for the Study of Rural Telemedicine was established at the University of Iowa with support from the National Library of Medicine (Contract N01-LM-4-3511). The purpose of the Laboratory was to determine health care delivery needs in the rural setting, develop technical approaches toward their solution, and test these applications in community settings. In the process, a unique test-bed network was established and available for the work of the current NLM contract (N01-LM-6-3548). A complete report of the initial work establishing the Laboratory and its programs can be reviewed at http://telemed.medicine.uiowa.edu.

The emphasis of the NLM project has been the evaluation of telemedicine as a means of providing health care services, with the emphasis on evaluation. The purpose of this report is to make available the results of our work during the contract period ending March 31, 2000.

Project Administration – Telemedicine Resource Center

Problem Addressed

In many settings, particularly rural ones, multi-component, multi-site projects involving telemedicine or other technologies are not feasible without appropriate administrative coordination and support. Successful research and development projects consist of a large number of discrete and diverse activities, many of which do not fall directly into easily assignable categories. We have utilized an administrative structure initially patterned after the very successful SCOR, or NIH Specialized Center of Research, programs funded at the University of Iowa. The TRC, like the SCOR administrative units, imposes a structure upon large and complex projects in several areas, including financial control, reporting, study design and analysis, regulatory compliance, information exchange and external relations. We believe the Telemedicine Resource Center has played a significant role in the success of both the individual projects and our overall program at Iowa.

Project Scope

The following summarizes the major responsibilities of the Telemedicine Resource Center at The University of Iowa:

- Administer, coordinate, and facilitate communication among telemedicine projects, telecommunications services, remote sites, and evaluation activities;

- Serve as the liaison to remote hospitals in our telemedicine network – provide end-user advocacy, training, and technical support to networked hospitals;
- Collect and manage utilization data for a variety of UI telemedicine programs and generate reports as requested;
- Provide teaching, training, internships, and practica opportunities for University of Iowa graduate students, medical students, and residents interested in learning about telemedicine;
- Host/train visitors to our telemedicine program from around the U.S. and from foreign countries
- Serve as an institutional resource on telemedicine to UI and outside entities;
- Administer all equipment requests, subcontracts, budgets, and consultant agreements for project directors;
- Use the telemedicine infrastructure and lessons learned to build out telemedicine services at The University of Iowa;
- Monitor state and national telehealth policy and contribute to legislation on telemedicine;
- Utilize NLM R & D projects to perform cost and viability studies for telemedicine;
- Disseminate information on UI's telemedicine program and NLM telemedicine activities via publications, presentations, the World Wide Web, newsletters, brochures, and other information dissemination mechanisms;
- Provide collection development services for telemedicine materials and make them available to users of Hardin Library for the Health Sciences;
- Contribute to the creation of a self-sustaining telemedicine program within the University of Iowa by evaluating cost recovery, reimbursement, and fee-for-service options.

Selected Accomplishments

The TRC staff used a variety of educational materials and sessions to help project directors and their staffs rapidly and efficiently plan and implement their work. This included helping with project budgets, procurement, travel, project planning and meeting management at UI and in involved communities. The TRC used a variety of communication strategies within the UI development group and with community hospital sites including secure email, a project intranet, a comprehensive WWW site, administrative videoconferencing, brochures and teaching materials, as well as site visits and on-campus meetings.

Managing a telecommunications project involving multiple facilities and covering a large region is daunting. Network performance was monitored and enhanced through a variety of strategies, including a mobile technical team, use of "black box" technologies for remote diagnosis and intervention, a telephone support line (800/606-4517) and end-user training.

The TRC staff played a major role in data management, particularly for those projects that did not have dedicated research personnel written into their projects. Specialized databases were developed (Telepsychiatry is an example) that could be modeled for use by other UI programs such as the

department of corrections telemedicine project. The TRC played a major role in assisting project personnel with Institutional Review Board procedures and reporting.

The TRC also provided coordination and oversight for a number of educational programs and initiatives relating to telemedicine, including preceptorship experiences for Masters and PhD candidates, foreign faculty, NLM Associates, and a variety of other visitors to our institution. A particularly important activity was developing and teaching a course on telemedicine that has been incorporated into the curriculum of the UI Physician Assistant program. (A manuscript on this topic was submitted to *Academic Medicine in March, 2000.*)

The expertise of the TRC in budget oversight and cost assessment has been key to the smooth operation of a project of this size. This expertise has been applied to a number of settings, including an assessment of the factors impacting cost in a start-up telemedicine network for Iowa's prison population.

The activities and results of work done by the Laboratory have been very effectively disseminated through the efforts of the TRC staff. These include a quarterly newsletter, "Health Connections," a comprehensive website (http://telemed.medicine.uiowa.edu), a variety of video productions illustrating the applications under development, presentation of results at numerous local, regional, national and international meetings and conferences, television and radio features and through written communications in magazines, journals and local and national newspapers.

Lessons Learned

Telemedicine development must start with an assessment of the problem that technology may or may not solve. It is unlikely that needs and problems will prove to be uniform across all rural hospitals and facilities. It should be remembered that technology implementation is inherently difficult in a remote and largely unsupported environment, so significant study and advanced planning should occur as early as possible, well before significant resources have been allocated.

Health care and technology environments are in a state of dynamic flux, and change must be anticipated and expected. The value of contingency planning cannot be overstated. To the extent possible, rapid prototyping and pilot testing should be employed and expectations of community-based collaborators should be informed by ongoing communication and education to minimize frustration and impatience that may occur when problems inevitably arise.

Human factors remain the most important determinant of success or failure of a specific application. Prominent among these factors include the 'politics' of patient referrals, fear of technology, impact on productivity of private and academic physicians, fragmentation of services at the local level, lack of local technical support, lack of reimbursement for most services, and differing opinions about health care priorities. These factors can be mitigated through advanced planning at the community level, a commitment to communication and training, and cultivation of key local liaisons and advocates.

Telemedicine has little chance for success as an independent activity. It must be integrated into an appropriate institutional environment and perceived as a useful tool to enhance existing relationships and delivery systems, not replace them. If an application cannot be incorporated into the mainstream of health care delivery within an institution or system, it will never be sustainable, either due to lack of use or lack of support, or both. The appropriate question to ask is, "How will telemedicine improve the services we can already deliver, or improve a relationship we already enjoy?" While it is popular to think of these technologies as *revolutionary*, in fact they are (and should be) *evolutionary*.

Plans for Continuation

The TRC will continue as a service unit of University of Iowa Health Care, the clinical delivery enterprise of the University of Iowa Hospitals and Clinics and the UI College of Medicine. The TRC will join the Health Information Resources Group, concentrating on refining and further developing video services, including video development, videoconferencing and distance education. The TRC will continue to support R&D projects that have a telehealth emphasis.

PEDIATRIC ECHO NETWORK

Problem Addressed

Pediatric Cardiology is a medical specialty that provides care for infants and children born with congenital heart disease. Of all neonates born, eight to nine per thousand are afflicted with congenital heart disease and many present during early infancy as medical emergencies requiring surgical therapy. Other cases are not as emergent but require special skills of pediatric cardiologists to define the nature of the disorders so that therapy can be recommended to prevent life long debility or premature death.

In the past two decades, the technique of two-dimensional echocardiography has been developed. This technique allows the accurate diagnosis of most congenital cardiac defects when applied by pediatric cardiologists or technicians under the direction of pediatric cardiologists. In many centers throughout the State of Iowa, echocardiographic instruments have been purchased because of the need for echocardiography in adult patients, but in most centers no pediatric cardiologist is available to direct or interpret studies of children with suspected congenital heart disease.

Project Scope

Given these considerations, the objectives of this project, were:

1. Establish on-line transmission of pediatric echocardiograms from several remote sites in Iowa.
2. Train personnel at the remote site in echocardiographic techniques required to diagnose congenital heart disease in infants and children and indications for obtaining pediatric echocardiograms.
3. Receive and interpret echocardiographic data from these sites.
4. Evaluate the impact transmission and interpretation of echocardiographic images has on the care of infants and children in small and medium sized towns in Iowa.

Selected Accomplishments

The project has been able to establish echo transmission sites from a number of communities, including those identified in the proposal and several others. Moreover, several transmission modes have been evaluated, including very high-bandwidth (DS3), high-bandwidth (ISDN-PRI) and conventional courier services. Over the contract period, 633 echocardiographic studies have been received from these sites.

A successful program for the education of adult sonographers has been developed to support high quality pediatric echocardiography in remote sites. This program includes written and other didactic materials, hands-on training, and ongoing training in the context of transmission of studies.

The utilization and usefulness of echocardiographic transmission have been studied in a number of ways during the project. We have found significant differences in diagnostic yield that are dependent upon the specialty of the physician ordering the test and the age of the child. Additional studies have identified key variables in turn-around time and referring physician satisfaction with tele-echocardiography services.

This work has been reported at national meetings and in peer-reviewed journals. The program will be continued as a major supporting service of statewide pediatric cardiology outreach clinics.

Lessons Learned

The feasibility and utilization of pediatric tele-echocardiography services is highly dependent upon the mix of providers available in the community. Once expertise is available in the community, the demand for services will decline to levels that make sustaining such a program unlikely. Training and support of key technical personnel in the community will be essential to the successful delivery of high quality and clinically useful studies.

Cost-effectiveness is a relative term. When the costs of community-based echocardiographic services are considered, comparisons must be based upon the cost of providing comparable services at the community site using traditional methods, rather than the costs of providing the service at a different site (like the tertiary hospital clinic). In the case of pediatric cardiology diagnostic services, the community based outreach clinic costs are the most appropriate comparison. These tend to be infrequent, but costly services for the outreach cardiologists to provide. The cost of making a diagnosis by tele-echocardiographic transmission or through an outreach clinic is comparable, if not lower.

Plans for Continuation

The Pediatric Echocardiographic network will continue operations with existing rural sites, and anticipates adding new sites in the next year. Additional funding has been secured from the Children's Miracle Network ($100,000) to continue these interactions and to implement others. A telemedicine classroom in pediatric cardiology is under development that will allow other pediatric cardiologists around the state to interact with UI Pediatric Cardiology.

EMERGENCY DEPARTMENT (ED) SUPPORT FOR VASCULAR ISCHEMIA

Problem Addressed

Emergency services are key to successful treatment of a number of clinical problems, particularly in a rural setting. Acute ischemic stroke and myocardial infarction are clinical problems with a very strong time sensitivity given the compelling benefits associated with definitive treatment in the first 3-4 hours after symptom onset. Many rural emergency rooms are not equipped to make diagnostic and therapeutic decisions within this narrow window of opportunity because of lack of provider expertise and familiarity with the necessary protocols that must be followed to provide care that is more routinely available to patients in a non-rural setting. Telemedicine has the potential to provide such guidance and speed the decision making process so therapy can be started in advance of transfer or other disposition.

Project Scope

The aims of the project were to 1) develop the database and software for rapid diagnosis and consultation of acute myocardial infarction (AMI) and acute brain infarction (ABI) patients; 2) integrate the software

with other data sources and teleconferencing software; 3) train physician users in use of the software and teleconferencing; 4) implement the system in 9 hospitals of varying sizes representing different capabilities and patient populations; 5) evaluate use of the system; 6) evaluate physician satisfaction at the local rural hospital and the tertiary hospital; and 7) evaluate patient outcome in terms of time to treatment, need for transfer, survival, functional outcome and cost of care.

Accomplishments

The project resulted in development of:

- A protocol using current clinical guidelines and practices,
- A means of dissemination of the guidelines and protocol through a conference, websites, local hospital presentations, and a comprehensive integrated database elements and algorithms,
- An integrated computer system for data transfer of neurologic exam, radiologic images, and clinical vital data,
- A system that utilizes scanners for paper documents and EKGs, still video cameras for imaging of radiologic films, and hand-held digital cameras for the neurological evaluation,
- An integrated pathway for consultation using a consultation network,
- A system of data transfer that provides information via the web which can make the consultation available through internet connections, and
- An assessment of videoconferencing and digital full motion imaging which still requires high-speed communication lines and computers with enough RAM dedicated to these process

Lessons Learned

It is possible to develop telemedicine approaches that arise from substantial need in a rural environment, are developed with full support and participation by community-based practitioners, demonstrate satisfactory diagnostic performance and facilitate guidelines-based practice, and still find the approaches underutilized in daily practice.

Complicating factors include fragmented systems of care for emergency services in the rural setting, a shifting level of clinical knowledge in the community, lack of perceived incentives for learning a new health delivery system, and entrenched reliance on more familiar (but less informative) means of communication.

Plans for Continuation

The University of Iowa has provided additional funding to extend telecommunications connections for an additional 3 months to allow more clinical experience, particularly in collaboration with a large Emergency Department (ED) group practicing at one of the test-bed sites. The application may also be modified to support specialty consultation within the UI Health Care environment itself.

TELEPSYCHIATRY CONSULTATION

Problem Addressed

In most rural settings the availability of mental health services is far outstripped by the demand for such services. This is particularly true for rural elderly patients, a population in which depression and other disorders are prevalent. While services can be provided in visiting consultant (satellite) clinics, serious

limitations exist with this model for both patient and provider. Telemedicine has the potential to improve access to services if acceptable to patients and providers, if quality can be maintained and costs are comparable, or at least acceptable.

Project Scope

Prior to initiation of this study, the study investigator (Dr. Rohland) had been providing services to each of the two proposed study sites though the University of Iowa Clinical Outreach Program. In the first year of the study, careful planning was directed at developing procedures such as triage, on-site assistance, and outcome measurement at each of the two proposed telemedicine study sites. In years two and three, Telepsychiatry services were delivered to one new rural site per study year. In each of years two and three, the other rural site served as a no-telemedicine treatment control group and patients at those sites received traditional face-to-face services through the pre-existing clinical outreach program. After one year as a Telepsychiatry demonstration site, the experimental site was converted to no-telemedicine treatment control, and the no-telemedicine treatment control was converted to a Telepsychiatry demonstration site in a crossover design.

Accomplishments

A cross-over design was successfully used with the two study clinics. Total clinical experience was relatively low, but the quality of data collection was excellent.

Face-to-face and Telepsychiatry care was rated equivalent by patients judged on an array of dimensions, and Telepsychiatry was judged preferable by patients by in several others.

Clinical status and outcomes at the end of the cross-over period were judged to be comparable between the two methods of delivery.

Lessons Learned

No significant, pervasive, or consistent technical problems were experienced during the course of the study. Having the assurance of consistent, reliable, and immediate access to technical expertise and support (provided through the Telemedicine Resource Center) was essential to the success of this project. Such support will be important in order to recruit and retain both physicians and patients to the use of this technology.

Financial barriers present the greatest obstacle to the widespread implementation of Telepsychiatry in rural areas. It is doubtful that local sites would have supported the costs of equipment and transmission had it not been provided through grant support. Furthermore, third party reimbursement would not have covered nurse or physician services that were provided under the auspices of this project. Because our telemedicine nurse traveled to both the face to face and the telemedicine sites, costs of transportation were incurred at both sites. For an ongoing program, contracting with a local provider for on-site clinical coordination and support would have eliminated the cost of transportation to the telemedicine site.

Most rural delivery systems are fragile. Telemedicine should be considered as an ancillary rather than a primary service; it should seek to supplement or support local resources rather than to replace, substitute or compete with them. If the introduction of Telepsychiatry by an outside provider erodes the financial base of local providers, local resources will be difficult to maintain and the community will become

dependent on a distant service provider who may not be committed to the overall well being of the local community. Local providers (and patients) may be reluctant to embrace Telepsychiatry (or other telemedicine services) if they are uncertain of the commitment and endurance of the providing agency. Furthermore, telemedicine is unlikely to be supported by local care providers (including referring entities) if they perceive it as being competitive to existing local resources, particularly services that they themselves provide. In the preliminary planning stages, local providers at potential telemedicine sites expressed willingness to refer only patients that represented a financial loss to the local provider (no third party coverage, or to groups of patients that were covered under a capitated contract that was deemed inadequate by local providers such as prison consultation and forensic court ordered evaluations).

An on site clinician (e.g., a nurse) is essential to the quality of Telepsychiatry. Although it raises concerns regarding confidentiality, it is essential for a clinical staff person to be present with the patient during the telecommunication. They must be able to troubleshoot technical problems (such as turning up the sound or refocusing the camera) as well as being prepared to address psychiatric emergencies such as threats of suicide or violence. At one of our sites, a patient expressed the intent to blow up a local electric company vehicle during the course of the evaluation. Appropriate (and immediate) follow-up would have been difficult had an on-site nurse not been present during this communication. The cost of an on-site provider, in addition to the telemedicine provider, is not likely to be reimbursed. Hence, telemedicine should not be promoted as cost saving. If done with an acceptable standard of clinical quality, it may be more expensive than traditional services. The primary advantage of telemedicine is that it provides a means to increase access to necessary or desirable services by patients who would otherwise not receive services or be underserved. Telepsychiatry should be viewed as an ancillary as opposed to a primary mechanism of service delivery in the provision of psychiatric services to persons who live in rural areas.

Administrative costs of scheduling and record documentation appear to be comparable to face-to-face assessment. However, it is important for measures to assure confidentially in the transfer and receipt of medical information via video transmission to be in place.

Telemedicine is an acceptable alternative to traditional face to face services by physicians, patients, and family members when it offers an advantage of convenience and/or cost over available alternatives. When patients have an established relationship with a treating psychiatrist, they appear to be willing to receive continuing services via telemedicine and appear to be able to do so without adverse consequences.

Plans for Continuation

Dr. Rohland has secured additional funding to continue telemedicine research in Texas. Dr. Flaum is working with state agencies such as the Department of Corrections and Iowa Medicaid to study use of telemedicine in these specific patient populations.

DIABETES EDUCATION

Problem Addressed

A number of studies and experiences have shown that education plays a major role in the outcome of patients with chronic illness. Recently reported data from diabetes intervention trials have demonstrated improved functional status with fewer complications when patients can more tightly regulate their blood glucose levels over time. At the same time, access to education about chronic illness is highly variable, particularly in remote settings, where specialized practitioners are unlikely to practice. Additionally, fewer health care resources are available for individualized patient education because of the declining

financial performance of many hospitals and health systems. Alternative approaches are needed for patients with chronic illness, perhaps through the application of new and emerging technologies.

Project Scope

The objectives outlined in the proposal focused on computer-assisted instruction (CAI) and its potential as a cost effective way to help diabetes patients in rural Iowa better understand and subsequently manage their disease. We set out to answer four fundamental questions:

1. Will the technology be accepted and used by patients with diabetes?
2. Is there a physiologic benefit of CAI?
3. Is there a psychological benefit of CAI
4. Will CAI impact knowledge of diabetes, diabetes management and the complications of diabetes?

Two approaches have been pursued. The first involved developing systems to support in-home education through devices connected to the Internet, particularly the WWW. The second involved using targeted on-demand video to supplement instruction that occurs in the hospital and clinic setting.

Accomplishments

A WWW-based diabetes community application has been developed and refined. This application includes a specialized database of information, a community forum, and a messaging system. The system is under study using a control group with cross-over design.

A detailed study of user preferences was performed by directly comparing two different WWW access platforms, the WebTV and the Apple iMac. While both appear to provide reasonable basic support for some functions, many characteristics important to the educational experience strongly favor the all-in-one iMac computer platform.

A working prototype of an enterprise-wide video file-server has been developed and populated with a variety of diabetes related materials in support of the project. This application, dubbed the UI Health Care/NLM Cineplex is in the early phase of patient testing. In its current configuration it will determine basic demographic information about the user, present a catalogue of relevant materials, display TV quality video and permit post-viewing queries to the user. The system will allow up to 100 simultaneous user to access the system.

Lessons Learned

The types and amount of information available to patients and health care consumers has proliferated dramatically since the beginning of this contract. A patient with diabetes in Iowa using the Internet is able to access information from all over the world. However, in order for this access to care to be optimally used and appropriately incorporated into local care, the information system should be part of a larger information "community" in which communication with care providers and other patients is an intrinsic part of the system.

The current technology environment is a difficult one for those who seek to improve access to information for patient communities. Changes in platform, software systems, telecommunications options and even basic programming language all impact on the route that development of systems may take. This occurs even when "off-the-shelf" solutions are favored and utilized. The net effect is one of

frequent re-direction of effort, re-engineering of approach, and exhaustion of human resources and project momentum.

Once systems are developed and ready for deployment, a great deal of effort is needed to assure that proper training and ongoing support have been allocated, designed and made available to patients and their families. This is particularly true for those who, by virtue of age, experience or financial status are unfamiliar with advanced technology. The incremental effort needed to connect the unconnected among us in the future will be considerable. Hopefully, with the passage of time the expectation of access to information resources will replace technophobia and re-establish a new baseline of user requirements.

Plans for Continuation

The University of Iowa has provided funding for additional telecommunications services to complete the cross-over study. Once validated, the Living with Diabetes format will be used to develop Internet communities for a number of chronic disease patient populations, such as cancer, asthma and others. The Cineplex application is being rolled out in the next month for patients and UI Health Care staff.

HOSPITAL SCHOOL

Problem Addressed

Among the estimated 50,000 to 70,000 children in the state of Iowa who have disabilities, there is a host of primary diagnoses including neuromuscular disorders, myelomeningocele, Down syndrome, mental retardation and other types of chronic health concerns. For those with more severe disabilities, these primary diagnoses are frequently compounded by secondary disorders, including chronic health problems resulting from the etiologies of the primary disorder and/or associated problems such as self-injury. Despite the high quality primary care and services to children with disabilities in Iowa, a significant number of these children exhibit complex anatomical, physiological, and/or behavior problems that require expert interdisciplinary evaluations and care planning that frequently are unavailable in their local communities.

This project was developed to test the potential of the Iowa Communications Network (ICN), a statewide fiber optic system, to assist the UHS to provide these selected tertiary level services in a manner that is optimally efficient for parents of the patients, community care and service providers, and UHS staff. An ICN studio was constructed at UHS and became operational in March, 1996. The studio is designed to provide optimum flexibility for live, fully interactive clinical service delivery.

Project Scope

This project was designed to evaluate selected clinical services that are now provided on site in UHS that can be provided by this telemedicine approach. The primary questions of this project focus on:

1. What types of selected clinical services or components that are now provided on site at UHS can be offered over the ICN effectively?
2. What is the satisfaction and reported effectiveness of providing telemedicine consultations to children/families and providers in a rural state in the view of families and their providers?

Accomplishments

During the performance of this project, the investigators have:

- Designed and tested the necessary procedures, protocols and processes to effectively deliver consultation through telemedicine to defined populations of children with disabilities.
- Evaluated the effectiveness of telemedicine consultation using a rigorous case-control design.
- Demonstrated that telemedicine consultation was at least as effective as face-to-face consultation from the perspective of patients, parents and providers.
- Demonstrated a substantial economic benefit to families and the agencies that support them by reducing costs related to travel expense and lost productivity.

Lessons Learned

The following factors are key lessons learned and the major issues in enhancing the success of telemedicine in this project for children and families in rural Iowa:

1. Collaborative and mutual development of clinical evaluation protocols is essential to success.
2. Local coordinator of scheduling familiar with local professionals and agencies is necessary.
3. Specific agenda for the telemedicine consultation prepared in advance insures quality.
4. Discussion of recommendations for treatments during the telemedicine consultation fosters 'best practices'.
5. Demonstration of evaluation/treatment procedures by professionals at both sites promotes learning.
6. Timely scheduling of requested consultations and evaluations is a key to successful local acceptance.
7. Quality and reliability of technical infrastructure of video connections is needed.
8. Adequacy and timeliness of written clinical reports following telemedicine consultations insures acceptance.
9. Prior training of local community-based professionals with telemedicine procedures is imperative.
10. Confidentiality of studio locations is central and must be maintained.
11. Pre-determined agenda for telemedicine sessions with designated manager at respective sites promotes a smooth clinical experience for all.
12. Preliminary introductions of all telemedicine participants – social etiquette is important.

Plans for Continuation

The following will occur as a result of the contract work:

- Incorporation of telemedicine consultation and evaluation model as part of the regular clinical service venue.
- Hosting a meeting (October 1999) with all 15 directors of Special Educational Services (service system for special education for the entire state of Iowa providing services for all of Iowa's school-age children and youth with disabilities – all types) and development of a statewide partnering of telemedicine services.
- Consultation with the Child Health Specialty Clinics (CHSC), the state Title V program for children with special health care needs. We anticipate the collaborative development of new telemedicine consultations in concert with this state/federal agency. Plans are currently in

process for new telemedicine sites and services: Feeding Disorders in Children with Special Needs, Down Syndrome Clinic, Children with Specialized Nutritional Needs, Postural/Support Service (special mobility, seating consultation), Specialized Consultation for Severe Behavioral Disorder (Des Moines Public School System in central Iowa) and Children with Pain (Juvenile Rheumatoid Arthritis).

- Continue to offer consultation services with the four care teams.

PATIENT CONFIDENTIALITY, SECURITY AND INFORMED CONSENT

The projects were carried out using a variety of computing and telecommunications approaches, including video (Disabled children consultation, Psychiatry consultation, echocardiographic transmission), WAN (Emergency Department support), and Internet (ED support, Diabetes education).

For video related projects, two approaches were taken. First, point-to-point ISDN has the same circuit security as a telephone call, with the added security of being a digitally encoded signal, requiring a decoder for use. For switched DS3 service on the Iowa Communications Network, transmissions were "blacked out" electronically and not viewable by telecommunications personnel.

For WAN applications used in the Emergency Department Support project, security and confidentiality was maintained using Windows NT challenge/response logon validation, digital certificates, and secure socket layer Internet protocols.

For the Diabetes Education project, in which security and confidentiality were of lesser concern (given the nature of the project), the experimental website was an unpublished URL and only patients participating as study subjects were registered to use its functions. If the system did not recognize the user's profile and IP address, access to the site would be denied. The site was moderated and monitored by study personnel.

Patient confidentiality was assured using existing policies and procedures in force within each hospital as related to privacy, medical record security and access to records. Each actively participating patient provided informed consent and each project was reviewed by the IRB at the University of Iowa.

CONCLUSIONS

Based on our collective experience gained during the current NLM contract, we offer the following brief and general conclusions:

Considerable economic benefit is provided to patients and their families by the improved access to specialty services and avoidance of costs associated with travel. When considered in the context of the clinical effectiveness of telehealth services, the case for telemedicine is even more compelling from the patient perspective.

For *providers* of specialty health care services, the value of the proposition is less clear, and may vary considerably from one clinical application to the next. Given the lack of routine reimbursement for telehealth services and the fact that the most significantly demonstrable economic value goes to patients and families, benefits for telemedicine service providers in the current environment are less obvious and must be viewed from a broader health system perspective. This perspective must take into account the favorable impact telemedicine programs may have on referral and other relationships. The extent to

which telemedicine is viewed as one of several tools for clinical relationship-building and patient care will determine whether decision-makers continue to support telemedicine programs when external funds terminate or are otherwise unavailable. Given the results of our current and past projects (and others), we believe that telemedicine is "safe and effective" and should be made available to patients and reimbursed on the same basis as traditional health care services. While the federal government has taken a few halting steps in endorsing this position, much more leadership is needed to put telemedicine on an appropriate footing in the health care system.

The implementation of telemedicine may prove to be difficult. The least of these difficulties is technology. Education, support, motivation, and training of providers are critical. The need to recognize and mitigate political and social factors that stand in the way of success are often ignored, at considerable peril. The incentives needed for full participation and evaluation of telemedicine are not yet present, particularly in the area of payment for service. We find ourselves in a "no job without experience and no experience without a job" situation. The somewhat slow and cumbersome efforts toward the documentation of telemedicine outcomes has created the (we believe) false impression that telemedicine doesn't work. Under the leadership of the National Library of Medicine, and with assistance from entities such as the Institute of Medicine, a more accurate picture of telemedicine is emerging.

Reba A. Benschoter, Ph.D.-

Is Professor and Director of Biomedical Communications at the University of Nebraska Medical Center in Omaha, NE From 1984 to 1994 she also served as the Dean of the UNMC School of Allied Health Professions. Since 1957, she has been involved in the development and application of educational technology at the University of Nebraska Medical Center and nationally and has assumed leadership roles in such organizations as the Health Sciences Communication Association and the Association of Biomedical Communications Directors. She has also served on national panels, study groups and grant review committees and is currently active in Nebraska Information Technology Commission work groups and sub-committees.

In 1964, she served as project director for a federal grant establishing the nation's first long-distance two-way medical television system linking UNMC with the state mental hospital in Norfolk, Nebraska. Through the years she has continued to work on the development of applications for the new video technologies. Today, under her direction, the Biomedical Communications unit provides full instructional media services including extensive two-way television network applications across Nebraska to support the Medical Center's health professions education in the major rural communities of the state.